

composed." The bearing of these facts on the question of vegetal coverings in the earlier periods is briefly discussed. Observations on organic rocks, and on the distribution and development of the fauna and flora, lead up to the subject of historical geology, which the authors propose to deal with in another volume.

H. B. W.

MACHINERY FOR HANDLING RAW MATERIAL.

The Mechanical Handling of Material. By G. F. Zimmer. Pp. xii+521; illustrated. (London: Crosby Lockwood and Son, 1905.) Price 25s. net.

IN the preface Mr. Zimmer says that he has been for twenty years professionally engaged in this branch of engineering, and he was recently induced to put together in the form of a treatise—the first in English on the subject—the mass of notes he had gradually accumulated. The importance of the subject is emphasised in the introduction by a few suggestive figures as to the amount of raw materials which has to be dealt with annually, and it may be noted that the wages of an ordinary labourer are equivalent to the interest on 1000*l.* of capital.

The question of the continuous handling of material is treated in the first section of the book; special prominence is given to elevators for the conveyance of corn and flour, and to the important problem of the supply of coke, ore, &c., to the top of blast furnaces; illustrations are given of the latest American furnace hoists. The system of band conveying, due to the inventive skill of Mr. Lyster, engineer to the Liverpool Docks, and the automatic throw-off carriage for such conveyors, also due to Mr. Lyster, are described in detail. Vibrating trough conveyors—the latest type of such machinery, and especially useful with any material which would deteriorate in rough treatment—are then dealt with. Tightening gears, power required, and speed of travel in the different types of conveyors are discussed in a special chapter, thus facilitating reference and comparison. The various types of pneumatic elevators, including the successful Duckham system for loading grain which has been extensively used, are next treated. This section of the book is concluded by a series of descriptions, in every case with illustrations, of conveyors which have been designed for special purposes, such as timber conveyors, hot coke conveyors for gas works, and casting machines for use with large blast furnaces.

The intermittent handling of material, mainly by endless chains and ropes, including the many systems of aerial cable-ways, forms the second section of Mr. Zimmer's book. One of the examples selected to illustrate the use of aerial ropeways is that used during the building of the new Beachy Head Lighthouse, and full credit is given to Messrs. Bullivant for the ingenious way in which the many practical difficulties were overcome. We may mention that it is to this system of aerial ropeway that the rapid completion of that remarkable bridge which will convey the Rhodesian railways over the great gorge of the Zambesi, almost within a stone's throw of the

famous falls, is due; it not only facilitated the erection of the bridge, but it also enabled the permanent way and rolling stock for the northern continuation of the railway line to be transported to the north bank of the gorge long before the bridge itself was completed. The interesting question of the coaling of ships at sea, a subject of special interest in view of the recent voyage of the famous Baltic Fleet to the East, forms the conclusion to this section.

The third section of the book is devoted to unloading and loading appliances. The discharging of vessels in docks, and the discharging of railway trucks—work requiring so much labour—have been fertile subjects of invention, and a large number of systems of grab-elevators and self-emptying trucks are described. In view of the enormous weight of coal annually shipped at the various coal shipping centres, no branch of the mechanical handling of material has received more attention than that of coal tips for loading colliers, and the chapter which treats of coal tips is a most complete and valuable one. In the last section of the book a number of miscellaneous devices, which the author has found it impossible to group under any of the previous divisions, are described, such as the automatic weighing of material, the coaling of railway engines, &c. Large flour and silo warehouses form an essential feature in the mechanical handling of raw materials such as grain and seed, and a couple of chapters, illustrated with the help of a number of plates, are given up to a detailed account of the main features of their design.

The book will be indispensable to all engineering firms, consulting engineers, and architects who have to deal with this important question either in the way of designing machinery or of erecting warehouses, and it is, though highly technical, a book which will appeal to the general reader anxious to obtain some slight knowledge of the latest advance in the mechanical handling and transport of the immense quantities of raw materials used daily in our industrial life.

T. H. B.

THE BUTTERFLIES OF INDIA.

The Fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council. Edited by W. T. Blanford. *Butterflies.* Vol. i. By Lieut.-Colonel C. T. Bingham. Pp. xxii+511; Figs. 94; Plates 10. (London: Taylor and Francis, 1905.) Price 20s.

NINETY years ago, when Kirby and Spence published the first volume of their "Introduction to Entomology," they considered it necessary to devote a whole letter, filling many pages, to refuting popular prejudices against the frivolity and uselessness of the study of entomology; and, no doubt, at that period butterfly-collecting was looked upon as a very silly, childish pursuit; while less than 200 years before, in the time of Charles II., a serious attempt was made to set aside the will of a certain Lady Glanvil, on the ground of insanity, as shown by her fondness for collecting butterflies.

Now, however, instead of butterfly-collecting being ridiculed, it has become almost necessary to discourage it in England in order to prevent the total extermination of all our rare and local species, while abroad it is pursued with enthusiasm by travellers and colonials, some of them belonging to the highest social circles. Again, during the last fifty years, so much light has been thrown on various scientific problems by the study of butterflies that eminent professors are ready to devote a great portion of their lives to such investigations.

Of late years, many Indian officers and civilians have taken up the collection and study of the butterflies of our Indian Empire, which are probably better known at the present time than those of any other part of the world outside Europe, except North America and South Africa. But there exists no complete work on the subject suitable for the use of students. Mr. F. Moore's great works on the butterflies of Ceylon and India are very bulky and costly, and the latter is still in progress, while the regretted death of L. de Nicéville left the work commenced by himself and Col. Marshall, and subsequently carried on by de Nicéville only, complete only as regards the earlier families. Lieut.-Colonel Bingham, a retired Indian officer, who has collected insects assiduously in many parts of India, Burma, &c., and who has already published two volumes on Hymenoptera in the present series, "The Fauna of British India," has been wisely chosen to supply the existing want of a manual of Indian butterflies, and with his previous practical experience behind him, and with sufficient leisure, and access to the collections and library of the Natural History Museum at South Kensington at his disposal, the work could not have been placed in better or more competent hands.

It is expected that three volumes will be required to deal adequately with the subject. Six families are admitted by the author, of which the first two, Nymphalidæ and Nemeobidæ, are discussed in the first volume. The arrangement of the work is similar to that which has been used in previous volumes of this series dealing with insects, which are already well known to all entomologists. The introduction, necessarily brief, contains remarks on classification, metamorphoses and structure, with text-illustrations of the larva and pupa of *Vanessa*, the head and body of *Argynnis* and *Charaxes*, and a very useful selection of figures of labial palpi, antennæ, neuration of wings, and legs. It is worthy of special remark that the author expressly discards the term "species" as liable to mislead, and uses "form" instead, as less objectionable.

Four hundred and seventy-nine species are described in vol. i., belonging to the Nymphalidæ (with six sub-families, *Danainæ*, *Satyrinæ*, *Acraeinæ*, *Libytheinæ*, *Morphinæ*, and *Nymphalinæ*), and *Nemeobidæ* (five genera only).

The text illustrations are excellent, and among the more interesting ones we may note Figs. 13 and 14, on p. 40, showing the variations in shape and markings of the forewings of seven specimens of *Euploea klugii*, Moore, and Fig. 94, on p. 501, of *Stiboges nymphidia*,

Butl., showing its remarkable resemblance to a species of the well-known tropical American genus *Nymphidium*.

Ten full-page plates (half-figures only) are added, drawn by Mr. Horace Knight and lithographed by the three-colour process by Messrs. Hentschel, and these alone are sufficient to give some idea to outsiders of the variety and beauty of the butterflies of India. If we take the butterflies of Great Britain at 70, those of Europe at 300, and those of British India, within the limits of the present work, at 1500, we shall have a fairly accurate idea of the proportions borne to each other by these three faunas:

In outlying districts, no doubt, many species still remain to be added to the Indian butterfly fauna, but apart from this, nothing is yet known of the transformations, habits, &c., of a great proportion of the insects, which will be sufficient to occupy the attention of numerous observers for many years. The metamorphoses of each butterfly, so far as yet known, are briefly noticed by Lieut.-Colonel Bingham, but it is only occasionally that he has been able to offer his readers any information of this description.

THE STATE AND AGRICULTURE.

The State and Agriculture in Hungary. By Dr. Ignatius Darányi, translated by A. György. Pp. xxii+264. (London: Macmillan and Co., Ltd., 1905.) Price 5s. net.

THERE are two fundamentally opposite theories of the duties of a public department dealing with a great industry such as the Board of Agriculture in this country—the one that its function is to foster the industry, the other that it is simply concerned in registering the progress and administering such legislative enactments as may be necessary from time to time.

Our English public offices have all grown up on the latter model, and the Board of Agriculture, which is always being abused for not doing this or that to improve the position of farmers, might legitimately answer that it was never designed to offer any such help to the agriculturist. Of course, the official apologists of the Board cannot put forward such a view nakedly; their plan is rather to divert the unreasonable attack by a show of activity.

To take a concrete case; the Board of Agriculture endeavours to eradicate swine fever—that it recognises as a proper function, true police work for agriculture—but supposing it should be urged to do something to improve the breed of pigs kept in England by introducing new breeds or by distributing boars of the right type in the backward districts, it would probably meet the demand by issuing a leaflet on "points to be aimed at in pig-breeding." The English method is cheap; it is also supposed to be bracing; and the English farmer, being subjected to the State-aided and bounty-fed competition of all other agricultural countries in the only open market, his own, is supposed to be in special need of a bracing régime.

So when people ask why the Board of Agriculture does not educate like France, or investigate like